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The survival rate of bridges. A study of 1674 bridges in 40 Dutch general practices

P.J.B. LEEMPOEL, A.F. KÄYSER, G.M.J.M. VAN ROSSUM & A.F.J. DE HAAN*

*Department of Oral Function and Prosthetic Dentistry, and *Department of Medical Statistics, University of Nijmegen, Nijmegen, the Netherlands*

SUMMARY **The survival rate of 1674 bridges and the influence of several factors on the lifetime of bridges were analysed, based on data from patient records that belonged to a random sample of 40 Dutch general practices. It appears that the 12 year survival rate of the bridges is 87%. There is a significant difference in the survival rate between the bridges that meet and do not meet Ante's law, and only a weak significant difference between the bridges with vital vs. non-vital abutment teeth. Gender and age of the patient, length of the bridge, presence of a post and core build-up, or the construction of the bridge (conventional fixed vs. cantilever pontic) appear to have no influence on the survival rate of the bridges in this sample.**

Introduction

In the Netherlands (15 million inhabitants) it is estimated that every year approximately 250 million Guilders or 130 million U.S. dollars are spent on bridges. The dental profession, therefore, should be able to predict the economical consequences of this treatment on the basis of durability data.

From the literature, only a few investigations are known that deal with the survival of bridges in general dental practices. One of the first studies on the durability of bridges was performed by Roberts (1970). He expressed the results in failure rate/year. More recent studies also used the term survival rate/year (Glantz *et al.*, 1984; Karlsson, 1986, 1989; Randow, Glantz & Zöger, 1986; Foster, 1990; Kerschbaum *et al.*, 1991; Valderhaug, 1991). Most recent data show a survival rate of approximately 90% after 10 years (Creugers, Käyser & van't Hof, 1994).

The aim of this study was to get an insight into the survival rate of bridges constructed in general dental practices in the Netherlands.

Materials and method

In this study, the data of 1674 bridges in 1080 patients were collected through a sample of 40 Dutch general practitioners (representative for the group of dentists in the Netherlands, graduated between 1963 and 1973, in relation to place of graduation, year of graduation and place of residence). In each of their practices a random sample was taken from the patients who had received a bridge, and from these patients the dental records were studied (Leempoel *et al.*, 1989a). The distribution of patients according to gender was 416 males (39%) and 664 females (61%). The average number of bridges per patient was for both men and women ±1·5, and most patients belonged to the age group 31–50 years. At the end of the study 136 patients were lost-to-follow-up, which left a remaining 944 patients.

The distribution of the bridges according to length (number of units) and localization (mandible vs. maxilla) is shown in Table 1.

In 1926 Ante published his well known requirement for abutment selection (Ante, 1926). He stated that the

Table 1. Distribution of the bridges according to length and localization ($n = 1674$)

	Maxilla		Mandible	
	n	%	*n*	%
Two units	40	4	13	2
Three-four units	735	80	651	87
≥ five units	152	16	83	11
Total	927	100	747	100

periodontal surface of the abutment teeth should be equal to or larger than the surface of the replaced teeth. Jepsen (1963) calculated the average root surface of the various teeth. Based on these data, 1451 bridges (87%) were constructed according to Ante's law, and 223 (13%) did not meet this law. Furthermore, it can be said that 1403 bridges (84%) were made exclusively on vital abutment teeth. From the remaining 271 (16%) with non-vital abutment teeth, 178 (66%) had a post and core build-up; the other 93 (34%) had not. Most of the bridges (1439 or 86%) were constructed with a conventionally fixed pontic, the remaining 235 (14%) had a cantilever pontic.

To get insight into the survival rate of the bridges, including the censored ones, in this study the method of Kaplan–Meier was used (Kaplan & Meier, 1958). In a previous article this method was demonstrated in detail (Leempoel, van't Hof & de Haan, 1989b). The log rank test and the chi-square test were used for comparing the different types of bridges (Cox, 1972).

Results

The overall percentage of the 1674 bridges that survived a period of 1, 5, 10 and 12 years is 99·3 (±0·2), 97·5 (±0·4), 91·9 (±1·0) and 87·0 (±1·7), respectively.

In Fig. 1 the survival function of the bridges is presented graphically.

The influence of several factors on the survival rate of the bridges was analysed. These factors were the gender and the age of the patient (i.e. the age at insertion of the bridge), the length of the bridge, the criterion whether the bridge did meet Ante's law, the influence of the vitality of the bridge abutment teeth, the presence of a post and core build-up in these abutments, and the presence of a cantilever pontic.

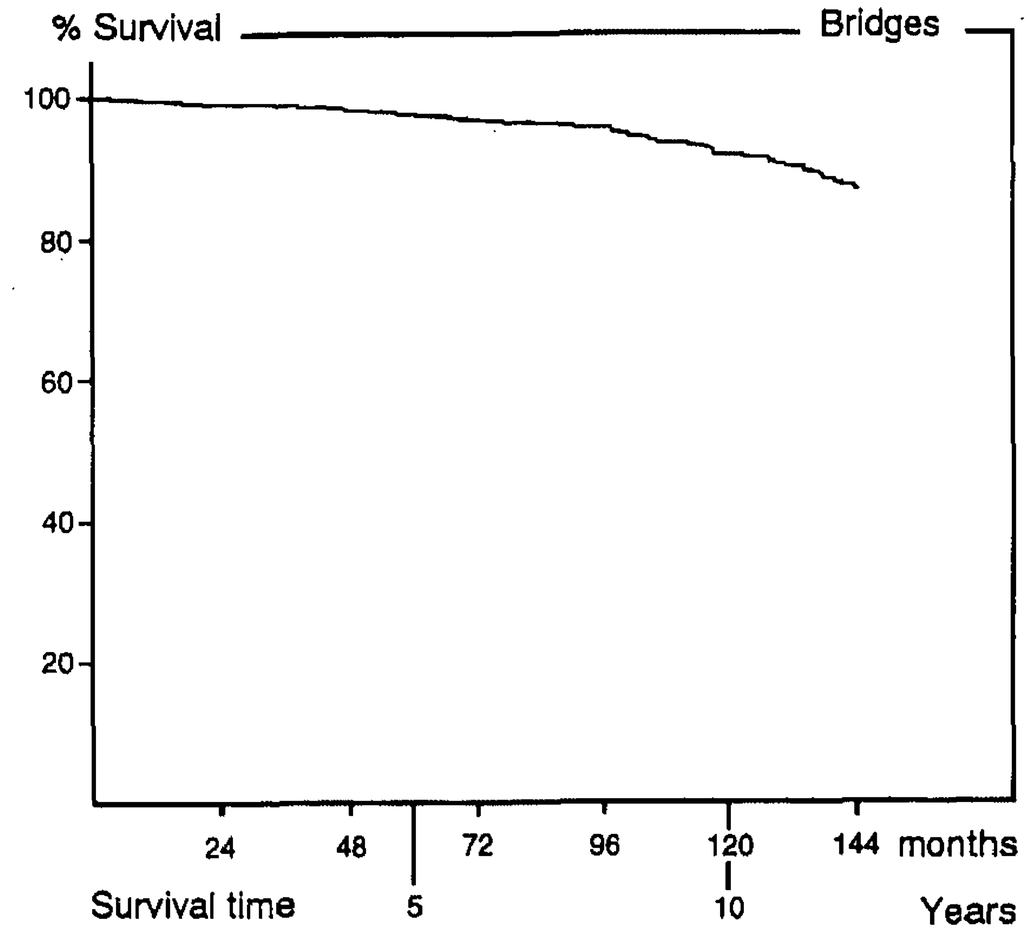

Fig. 1. Survival curve of the 1674 bridges, according to Kaplan & Meier (1958).

No significant difference in the survival rate of bridges between men and women (log rank test: $P > 0{\cdot}10$) or between different age groups could be found (log-rank-test: $P > 0{\cdot}10$) (Table 2).

The bridges that did not meet Ante's law had a significantly lower survival rate than the ones that did meet this law (chi-square test: $P < 0{\cdot}05$). The bridges with non-vital abutment teeth had a weaker significant lower survival rate than the ones with vital abutment teeth (log rank test: $0{\cdot}05 < P \leq 0{\cdot}10$). However, no significant difference in the survival rate could be found between bridges with a conventionally fixed pontic and the ones with a cantilever pontic (log rank test: $P > 0{\cdot}10$), between bridges of various length (log rank test: $P > 0{\cdot}10$) or between bridges with and without a post and core build-up (log rank test: $P > 0{\cdot}10$) (Table 3).

Discussion

The results of this study are comparable with the results of Kerschbaum *et al.* (1991). In a similar study they found 92% survival after 8 years and 64% after 15 years. Karlsson's studies showed a survival rate of 93% after 10 years (1986) and 67% after 14 years (1989). Examining the curve in Fig. 1 closely, it seems that after 8–10 years the survival rate decreases progressively. This phenomenon was also detectable in the study of Valderhaug (1991), who found 88% survival after 10 years and 68% after 15 years. The explanation for a

Table 2. Percentage of bridges (± s.e.) that survived a period of 1, 5, 10 and 12 years according to gender and age of the patients

	1 year	5 years	10 years	12 years
Gender				
Men ($n = 644$)	99·5 (±0·7)	97·8 (±0·6)	92·6 (±1·6)	90·4 (±2·2)
Women ($n = 1030$)	99·1 (±0·3)	97·3 (±0·5)	91·5 (±1·3)	85·1 (±2·3)
Age				
0–30 ($n = 476$)	98·1 (±0·6)	95·9 (±0·9)	92·6 (±1·7)	88·8 (±3·1)
31–50 ($n = 689$)	99·7 (±0·2)	98·8 (±0·4)	91·0 (±1·9)	86·1 (±3·0)
> ($n = 146$)	100·0 (±0·0)	97·7 (±1·3)	95·0 (±2·0)	87·1 (±7·8)

Table 3. Percentage of bridges (±s.e.) that survived a period of 1, 5, 10 and 12 years according to number of units (bridge length), 'meeting Ante's law', the vitality of the abutment teeth, the presence of a post and core build-up and the construction

	1 year	5 years	10 years	12 years
Number of units				
Two ($n = 53$)	98·1 (±1·9)	94·3 (±3·2)	88·7 (±4·9)	83·8 (±6·7)
Three-four ($n = 1386$)	99·4 (±0·2)	97·8 (±0·4)	92·2 (±1·1)	86·8 (±2·0)
≥ five ($n = 235$)	98·7 (±0·7)	96·9 (±1·2)	90·8 (±2·7)	88·7 (±3·3)
Ante's law				
Yes ($n = 1451$)	99·4 (±0·2)	97·7 (±0·4)	92·7 (±1·0)	88·3 (±1·8)
No ($n = 223$)	98·7 (±0·8)	96·6 (±1·3)	86·5 (±3·5)	78·8 (±5·4)
Abutment teeth				
Vital ($n = 1403$)	99·3 (±0·2)	97·6 (±0·4)	92·9 (±1·0)	87·7 (±1·9)
Non-vital ($n = 271$)	99·3 (±0·5)	97·4 (±1·0)	87·1 (±3·1)	83·4 (±3·9)
Post and core build-up				
Yes ($n = 178$)	99·4 (±0·6)	97·2 (±1·3)	86·8 (±3·9)	81·7 (±5·1)
No ($n = 93$)	98·9 (±1·1)	97·7 (±1·6)	88·0 (±5·0)	88·0 (±5·0)
Pontic				
Conventional ($n = 1439$)	99·2 (±0·2)	97·7 (±0·4)	92·3 (±1·1)	87·2 (±1·9)
Cantilever ($n = 235$)	99·6 (±0·4)	96·5 (±1·2)	89·8 (±2·9)	85·8 (±3·9)

progressive decrease in survival after approximately 10 years is not exactly known. Fatigue and ageing of used materials, such as metal alloys, porcelain and cement could play a role (Creugers *et al.*, 1994).

Randow *et al.* (1986) found that technical failures increased progressively with the number of cantilever pontics used. This could only be substantiated partially in this study as the relation between number of cantilevers and survival was not analysed. The negative influence of non-vital teeth, found in most other studies, was confirmed in this study.

It was stated that the law of Ante is actually outdated as a method for abutment selection (Laurell *et al.*, 1991). The health of the really available periodontal area is of more importance than the static law of Ante. However, it still has some merit as a general guideline.

The results of this study might be influenced in a positive way (overestimation of the results) as some selectivity is not to be excluded in the participating dentists (Leempoel *et al.*, 1989b).

Conclusions

Within the confinements of this study it is concluded that bridges are durable restorations, showing an overall survival of 91·9% after 10 years; the survival rate is influenced in a negative way when the law of Ante is not met in abutment selection; non-vital abutments tend to decrease the survival rate; after 10 years the survival of bridges seems to decrease progressively.

References

ANTE, I.H. (1926) The fundamental principles of abutments. *Michigan Dental Society Bulletin*, **8**, 14.

COX, D.R. (1972) Regression models and life tables. *Journal of the Royal Statistic Society*, **34**, 187.

CREUGERS, N.H.J., KÄYSER, A.F. & VAN'T HOF, M.A. (1994) A meta-analysis of durability data on conventional fixed bridges. *Community Dentistry and Oral Epidemiology*, **22**, 448.

FOSTER, L.V. (1990) Failed conventional bridge work from general dental practice: clinical aspects and treatment needs of 142 cases. *British Dental Journal*, **168**, 199.

GLANTZ, P.-O., RYGE, G., JENDRESEN, M.D. & NILNER, K. (1984) Quality of extensive fixed prosthodontics after 5 years. *Journal of Prosthetic Dentistry*, **52**, 475.

JEPSEN, A. (1963) Root surface measurement and a method for X-ray determination of root surface area. *Acta Odontologica Scandinavica*, **21**, 35.

KAPLAN, E.L. & MEIER, P. (1958) Nonparametric estimation from incomplete observations. *Journal of the American Statistic Association*, **53**, 457.

KARLSSON, S. (1986) A clinical evaluation of fixed bridges, 10 years following insertion. *Journal of Oral Rehabilitation*, **13**, 423.

KARLSSON, S. (1989) Failures and length of service in fixed prosthodontics after long-term function. A longitudinal clinical study. *Swedish Dental Journal*, **13**, 185.

KERSCHBAUM, T.H., PASZYNA, C.H., KLAPP, S. & MEYER, G. (1991) Verweilzeit- und Risikofaktorenanalyse von festsitzendem Zahnersatz. *Deutsche Zahnärtzliche Zeitschrift*, **46**, 20.

LAURELL, L., LUNDGREN, D., FALK, H. & HUGOSON, A. (1991) Long-term prognosis of extensive polyunit cantilevered fixed partial dentures. *Journal of Prosthetic Dentistry*, **66**, 545.

LEEMPOEL, P.J.B., VAN ROSSUM, G.M.J.M., DE HAAN, A.F.J. & REINTJES, A.G.M. (1989a) Bridges in general dental practices: a descriptive study of the types of bridges and patients. *Journal of Oral Rehabilitation*, **16**, 381.

LEEMPOEL, P.J.B., VAN 'T HOF, M.A. & DE HAAN, A.F.J. (1989b) Survival studies of dental restorations: criteria, methods and analyses. *Journal of Oral Rehabilitation*, **16**, 387.

RANDOW, K., GLANTZ, P.-O. & ZÖGER, B. (1986) Technical failures and some related clinical complications in extensive fixed prosthodontics. An epidemiological study of long-term clinical quality. *Acta Odontologica Scandinavica*, **44**, 241.

ROBERTS, D.H. (1970) The failure of retainers in bridge prostheses. *British Dental Journal*, **128**, 117.

VALDERHAUG, J. (1991) A 15-year clinical evaluation of fixed prosthodontics. *Acta Odontologica Scandinavica*, **49**, 35.

Correspondence: Prof. Dr A.F. Käyser, Department of Oral Function and Prosthetic Dentistry, School of Dentistry, PO Box 9101, 6500 HB Nijmegen, the Netherlands.